PIPE - IN - PIPE

FLOWLINE INSTALLATIONS

IN THE GULF OF MEXICO

BY C. G. LANGNER

Pipe-In Pipe Flowline Installations in the Gulf of Mexico

by C. G. Langner

In the U.S. Gulf of Mexico, flowlines are constructed in concentric Pipe-In-Pipe configurations primarily to achieve high thermal insulation for flow assurance purposes. Keeping the internal fluids warm helps prevent formation of hydrate plugs and reduces paraffin deposition which can constrain the flow. A pipe-in-pipe in which the annulus is filled with low density foam, provides better insulation than a comparable single pipe externally coated with a more dense, pressure resistant foam, even when the latter is buried in the seafloor to reduce heat losses. This presentation describes several recent Pipe-In-Pipe flowline installations, and illustrates the various techniques for applying the insulation, assembling the pipe joints, and installing the flowlines offshore.

Pipe-In-Pipe Flowline Installations in the Gulf of Mexico

Company	Field	Pipe Sizes	Length	Year	Lay Method	Host Platform
Shell	Rocky	3" x 6"	2 x 3 mi	1995	Reel	Bullwinkle
Shell	Tahoe	4" x 8"	2 x 12 mi	1997	Reel	Bud light
BP	Troika	10" x 24"	2 x 14 mi	1998	Tow	Bullwinkle
Shell	Macaroni	6" x 10"	2 x 12 mi	1999	J-Lay	Auger TLP
Marathon	Arnold	4" x 8"	- - - -	1999	Reel	- - - -
Shell	Europa	8" x 12"	2 x 18 mi	1999	J-Lay	Mars TLP
Shell	Nakika	8" x 12"	6 x 3 mi	future	J-Lay	FPSO *
Amoco	King	8" x 12"	2 x 18 mi	future	- - -	Marlin **

* Planned to be electrically heated

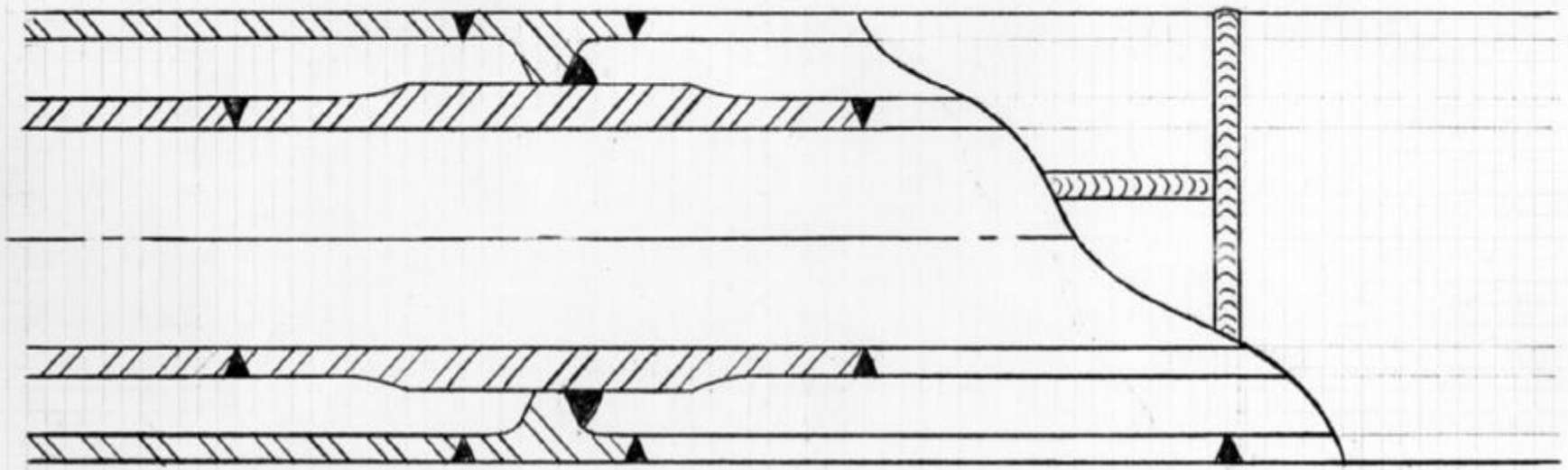
** Planned to be water heated

Pipe-In-Pipe Annulus Insulation Techniques

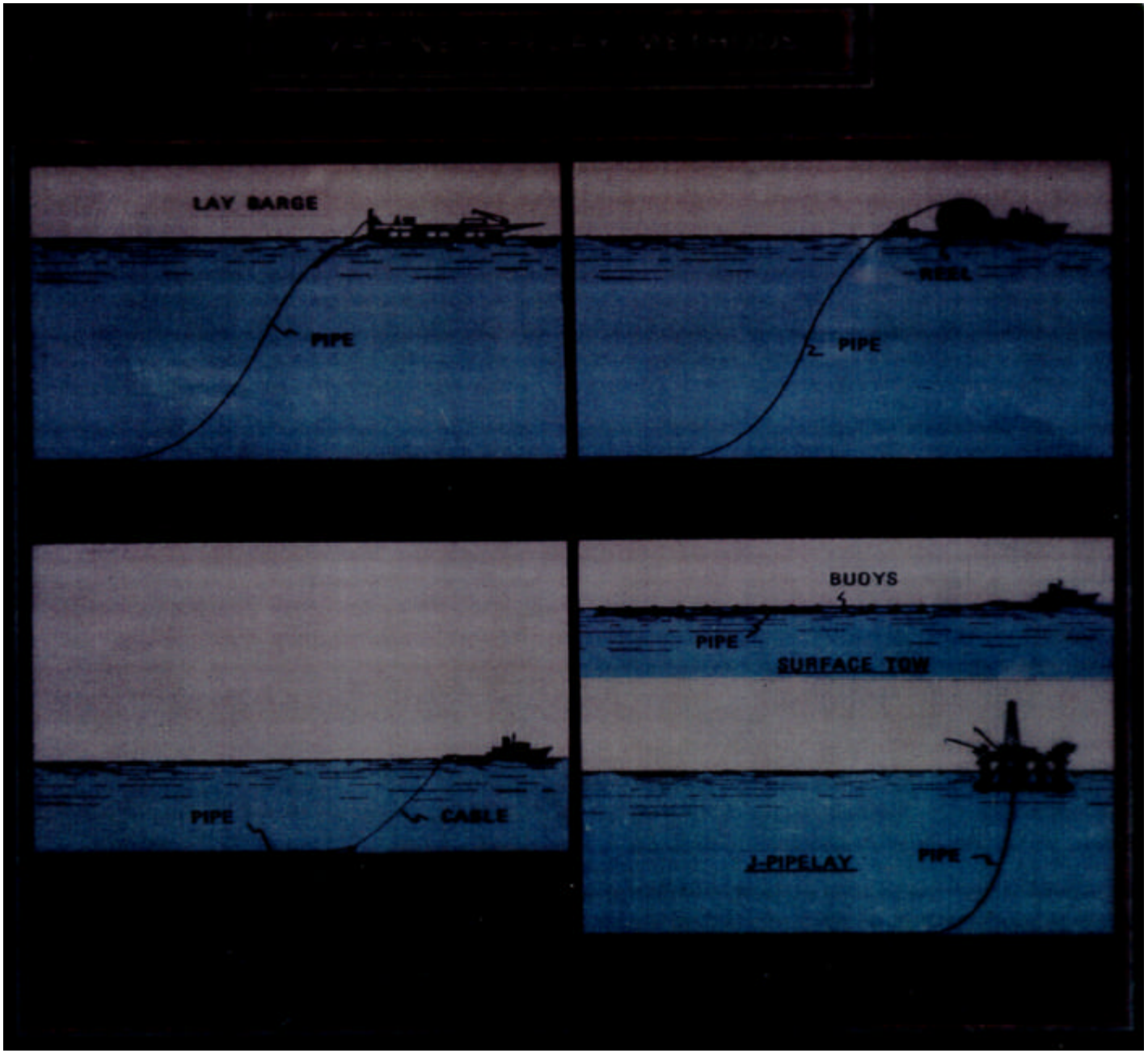
Insulation is typically 3-6 pcf polyurethane foam expanded with CO2 blowing agent.	Example Flowlines
1. Foam clamshells taped onto inner pipe, with centralizers spaced 20'-40' apart, assembled by sliding the pipes together.	- Rocky - Tahoe - Troika
2. Foam and hard-jacket sprayed onto inner pipe, with no centralizers, assembled by sliding inner and outer pipes together.	- Macaroni - Arnold - Europa
3. Foam or ceramic microspheres injected into annulus after pipes are assembled and centralized. Field joints require expensive welding of split sleeves or similar devices as pipes are bonded together.	- European PIP flowline practice

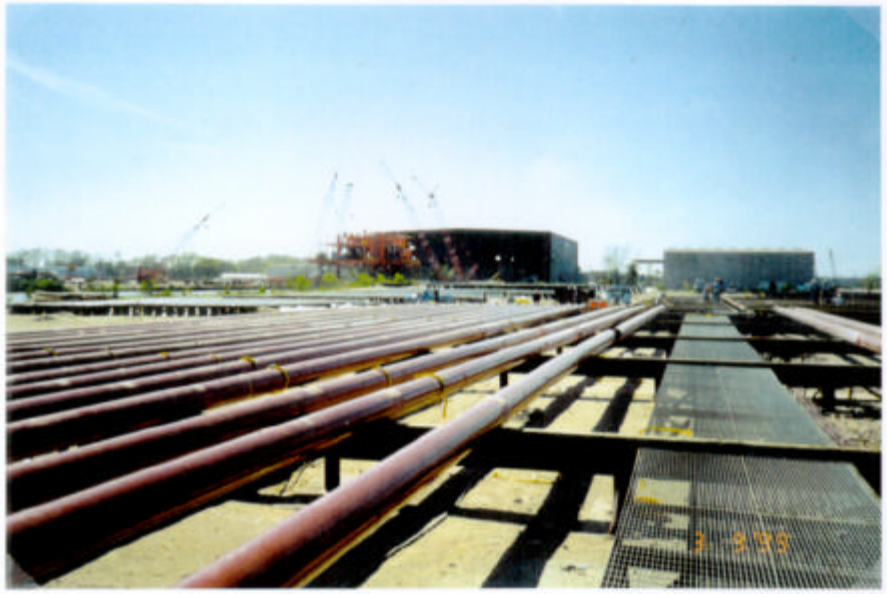
Installation Procedures for Pipe-In-Pipe Flowlines

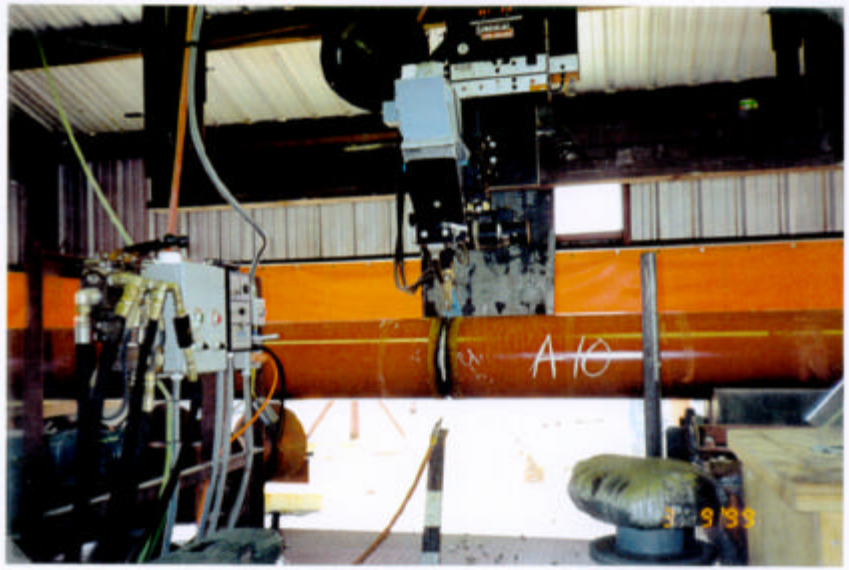
J-Lay or S-Lay	1. Suspend flowline by J-Lay collar or tensioner 2. Install load-sharing/water stop device in annulus 3. Weld inner pipe ends 4. NDT inner weld and install annulus insulation 5. Slide outer pipe in place and weld outer pipe ends 6. NDT outer weld and corrosion coat field joint 7. Pay out one joint length of pipe-in-pipe 8. Move up lay vessel
Reel-Lay or Tow	1. Weld inner and outer pipes into separate strings 2. NDT and corrosion coat inner and outer welds 3. Apply insulation and centralizers to inner pipe 4. Slide inner strings into outer strings 5. Join pipe-in-pipe strings to form the pipeline 6. Spool pipeline onto reel for Reel method 7. Launch pipeline into surf for Tow method



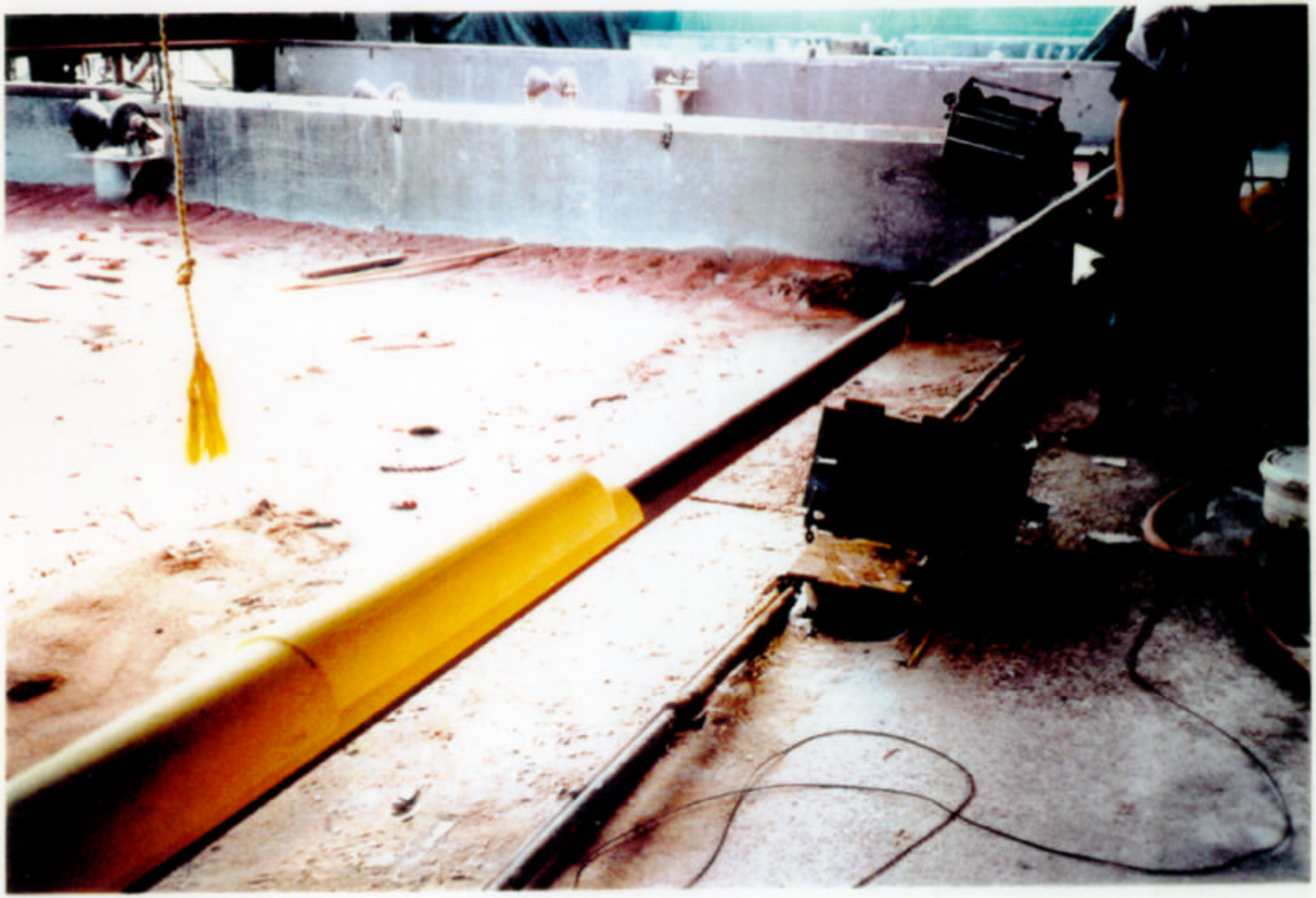
TYPICAL STEEL BULKHEAD USED FOR PERIODIC WATER STOPS ALONG ANNULUS AND LOAD SHARING BETWEEN THE PIPES

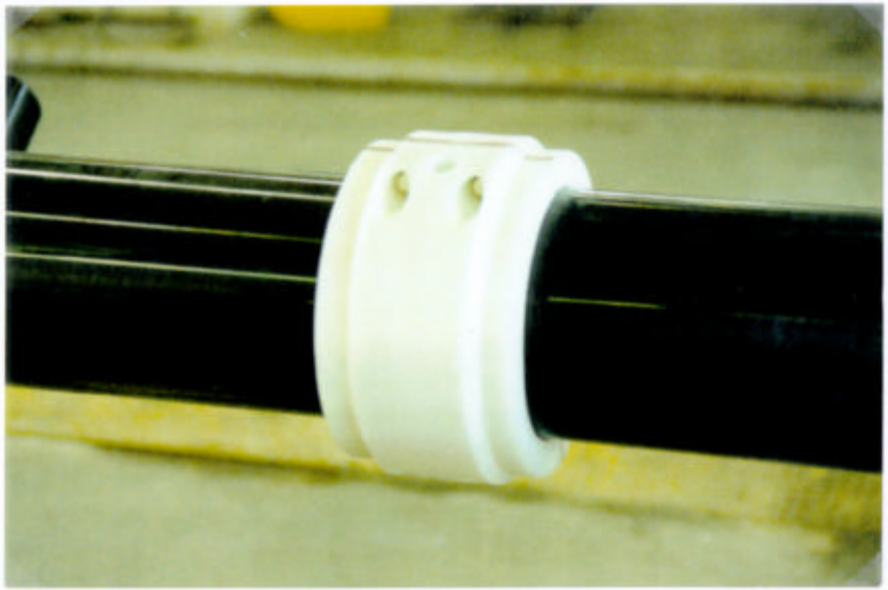

LAY BARGE
PIPE
REEL
PIPE
PIPE
CABLE
BUOYS
PIPE
SURFACE TOW
J-PIPELAY
PIPE

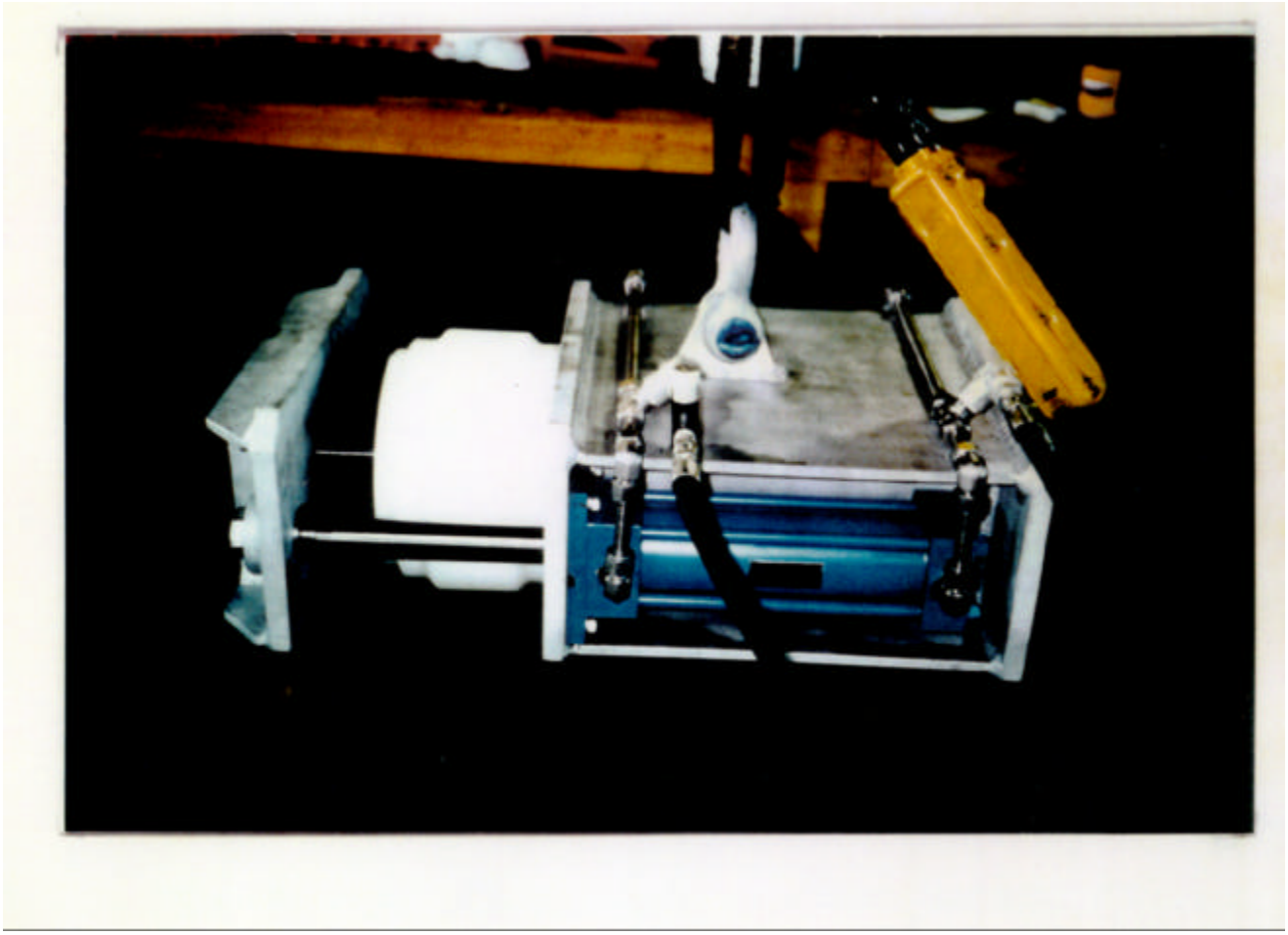


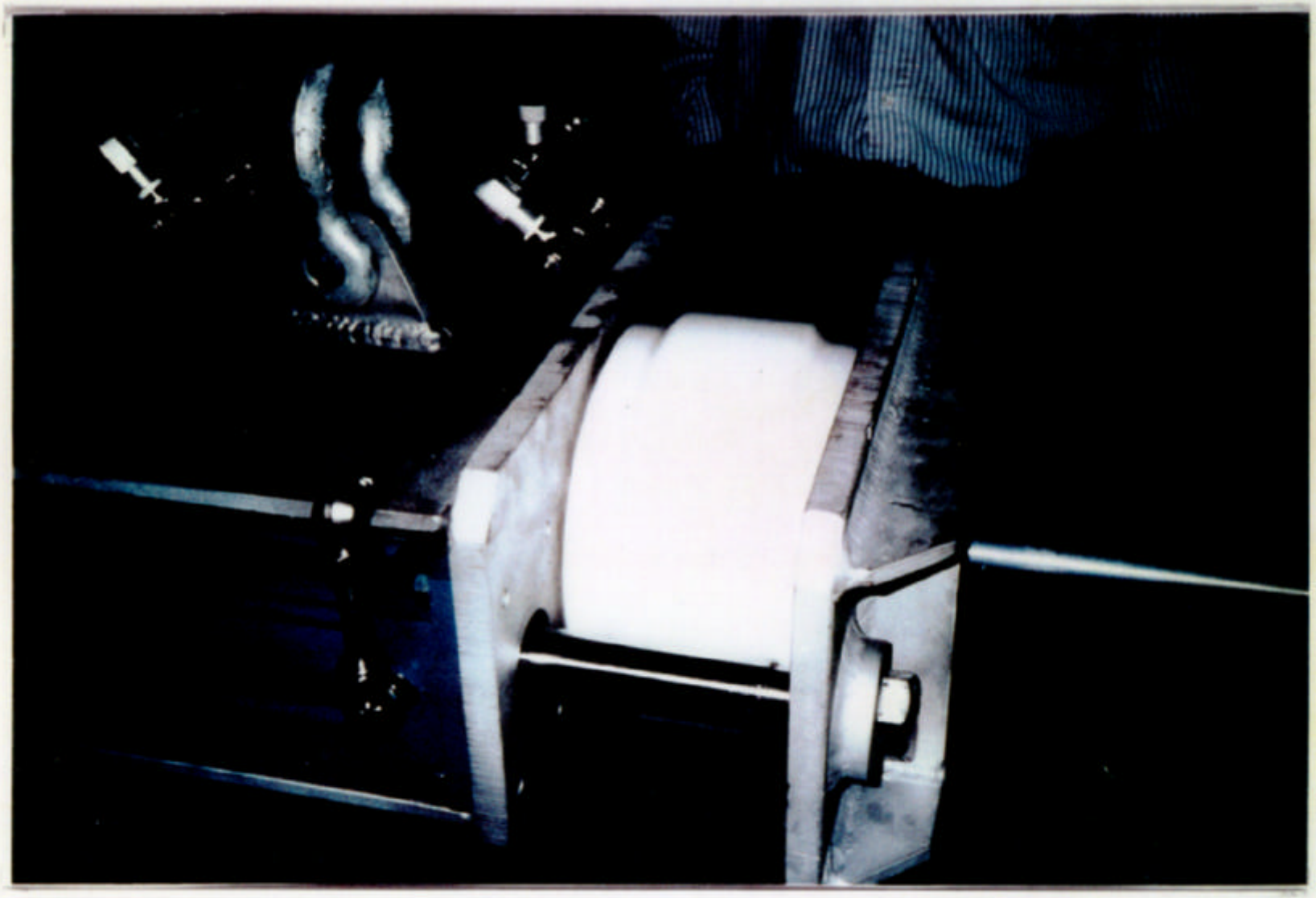

A10

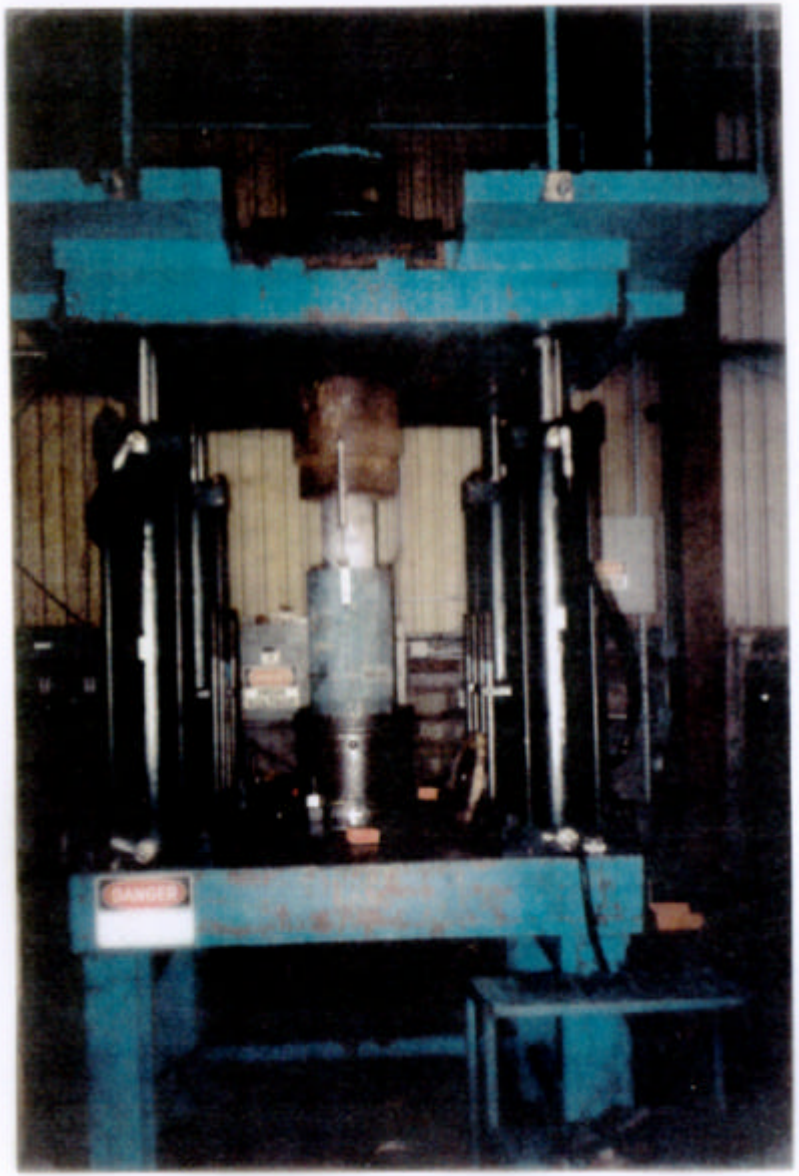

GALION

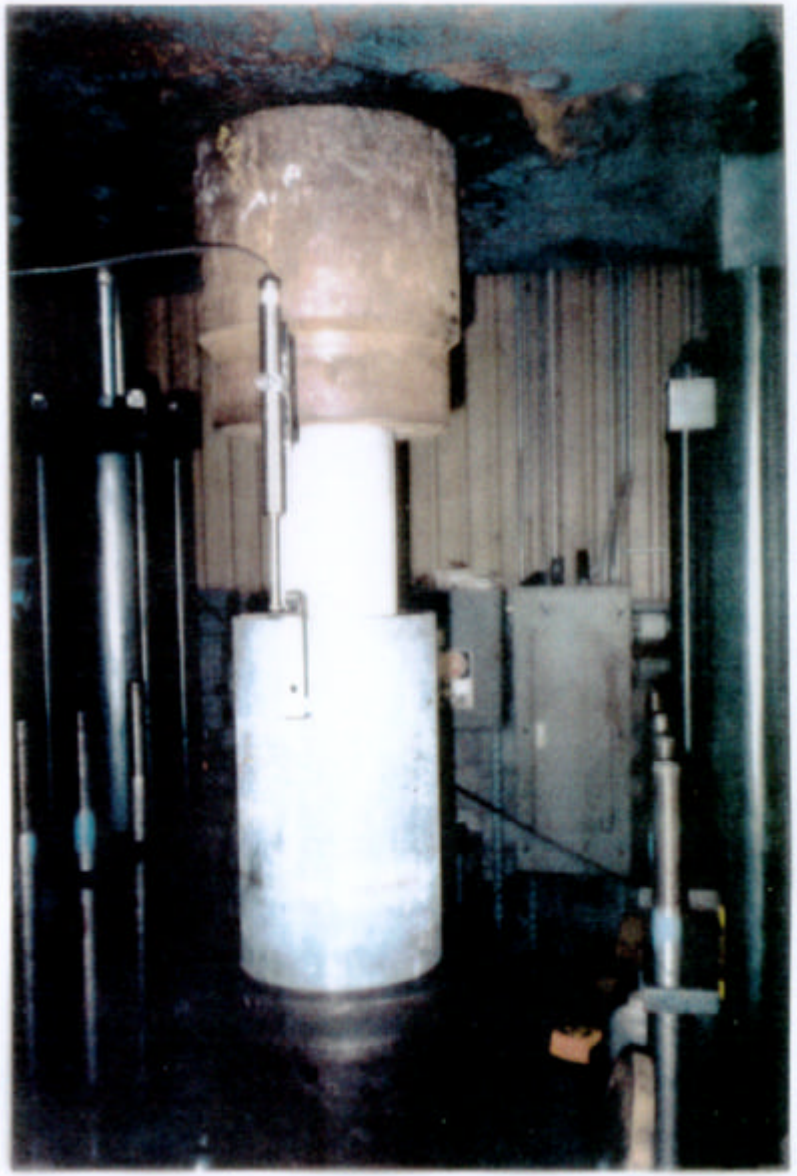


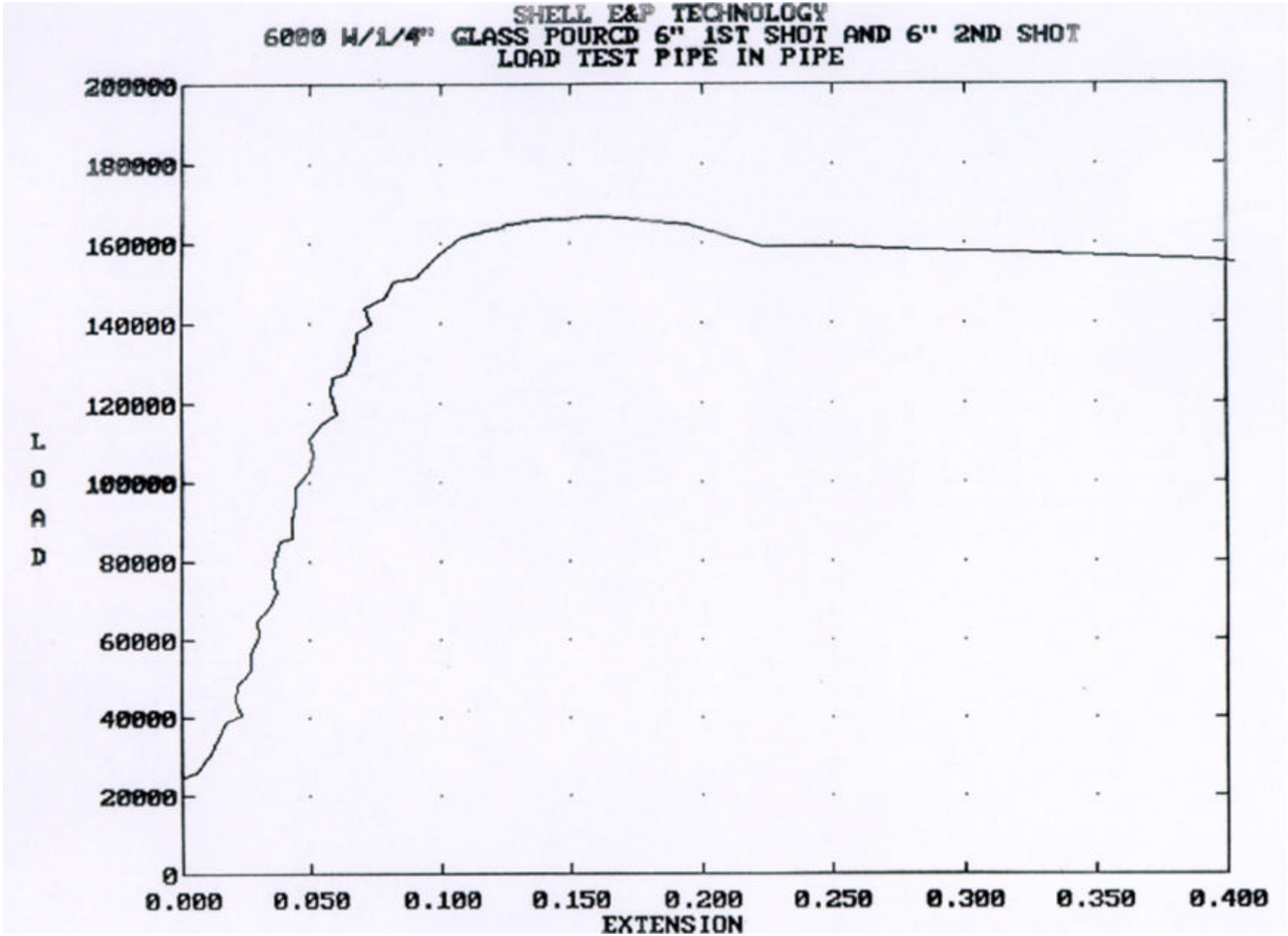


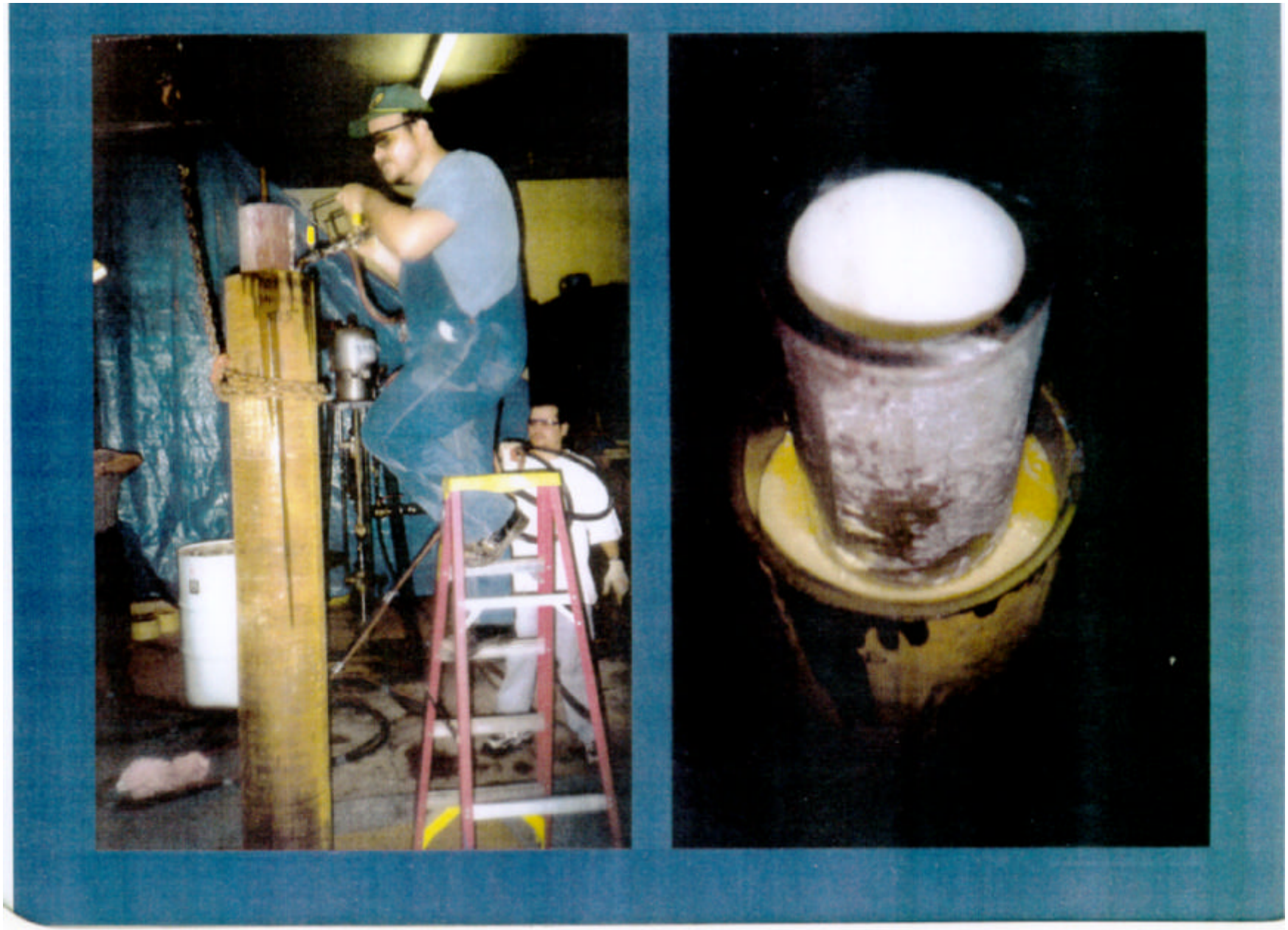


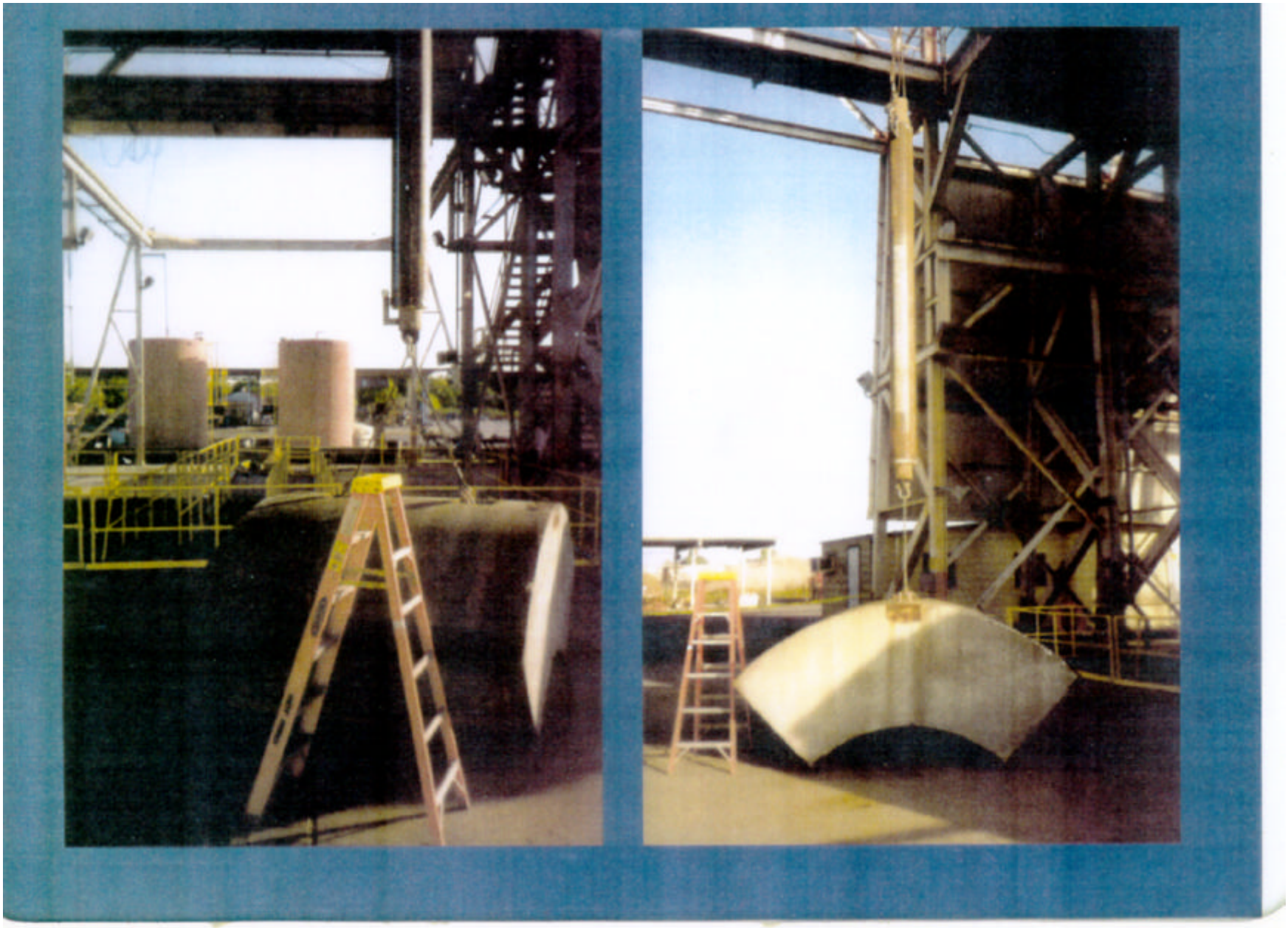



DANGER




SHELL E&P TECHNOLOGY
6000 W/1/4" GLASS POURCD 6" 1ST SHOT AND 6" 2ND SHOT
LOAD TEST PIPE IN PIPE
200000
180000
160000
140000
120000
100000
80000
60000
40000
20000
0
L
O
A
D
0.000
0.050
0.100
0.150
0.200
0.250
0.300
0.350
0.400
EXTENSION






S-2L
CAUTION DO NOT ENTER